Protein - Water Interactions: A Differential Approach, 2014, pages 107-124

Analysis of the organic solvent effect on the hydration and structure of alpha-chymotrypsin by ftir spectroscopy

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Abstract

© 2014 by Nova Science Publishers, Inc. All rights reserved. The effect of acetonitrile (AN) on the hydration and structure of bovine pancreatic α-chymotrypsin (CT) was characterized using FTIR spectroscopy at 25°C. The obtained results show that the hydration and structure of a-chymotrypsin depend markedly on how enzyme has been hydrated - whether in the presence or in the absence of organic solvent. Acetonitrile decreases markedly the water content at a given water activity (aw). This behavior suggests that the suppression in the uptake of water is due to a competition for water-binding sites on α-chymotrypsin by acetonitrile. Changes in the structure of CT were determined from infrared spectra by analyzing the structure of amide I band. It was found that, at low water activity, the protein-protein contacts in the dried enzyme largely govern its thermodynamic, structural, and functional properties. At high water activity, the chymotrypsin state is determined by the enzyme-organic solvent and enzyme-water interactions resulting in the enzyme denaturation. The interplay of these two factors is responsible for the observed complex shape of the enzyme storage stability - aw curves, with an extremum at intermediate water activity values.

Keywords

Acetonitrile, Biocatalysis in organic solvents, Bovine pancreatic α-chymotrypsin, Enzyme hydration and structure, Fourier transform infrared spectroscopy (FTIR spectroscopy)